Crystal ball questions on Level 3 Isomers

All of the following questions have not (as yet!) appeared in the NCEA Level 3 Exams

1) Lactic acid is a carboxylic acid with the chemical formula $C_3H_6O_3$, the IUPAC name for Lactic acid is 2-hydroxypropanoic acid.
i) During vigorous exercise our bodies makes lactic acid, which splits into the lactate ion and hydrogen ion. The burn felt during exercise is caused by hydrogen ion buildup. Draw a sketch of the lactate ion.

ii) Lactic acid is a an enantiomer, draw a 3D diagram of the mirror images of lactic acid

iii) Lactic acid extracted from meat is known as Dextro lactic acid and lactic acid produced during fermentation of sugar by Bacillus aceti is known as Laevo lactic acid. Discuss the similarities and differences in the properties of the two enantiomers of lactic acid.

2) i) Draw (an expanded structural diagram) and name a secondary alcohol that is a stereoisomer.

ii) Draw a 3d diagram of the two mirror images of the isomer named above.

iii) Explain why the secondary alcohol you have drawn is a stereoisomer.

iv) Describe how to make a racemic mixture of the stereoisomer

3) 2-aminopropanoic acid (alanine) has two enantiomers (optical isomers) because it has a chiral molecule containing an asymmetric carbon atom. One enantiomer is a non-superimposable mirror image of the other. The two enantiomers rotate the plane of polarisation of plane polarised light in opposite directions, but 2-aminopropanoic acid can also be found as a racemic mixture which has no effect on the plane of polarisation.

i) Draw the structures of the two enantiomers. Use your diagram to explain what is meant by the term *non-superimposable mirror image*.

ii) Explain what is meant by a *chiral molecule* and say how you would recognise an *asymmetric carbon atom*.

iii) Why doesn't a racemic mixture have any effect on the plane of polarisation of plane polarised light?

question 4 question referenced from chemguide http://www.chemguide.co.uk/basicorg/questions/q-optisomerism.pdf